EFFECTIVENESS OF SENSORY INTEGRATION ON ATTENTION DEFICIT HYPERACTIVITY DISORDER

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THE DISSERTATION ENTITLED

"EFFECTIVENESS OF SENSORY INTEGRATION ON ATTENTION DEFICIT HYPERACTIVITY DISORDER "

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Dissertation submitted to

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Dissertation evaluated on ----------

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CERTIFICATE I

This is to certify that the dissertation entitled**"EFFECTIVENESS OF SENSORY INTEGRATION ON ATTENTION DEFICIT HYPERACTIVITY DISORDER"** was carried out by Reg.No.27102316 P.P.G College of physiotherapy, Coimbatore-35, affiliated to the Tamilnadu Dr. M.G.R medical university, Chennai-32, under the guidance of Prof. M. SHANKAR. M.P.T (NEURO), MIAP.

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This is to certify that the dissertation entitled **"EFFECTIVENESS OF SENSORY INTEGRATION ON ATTENTION DEFICIT HYPERACTIVITY DISORDER"** was carried out by Reg. No. 27102316 P.P.G College of physiotherapy, Coimbatore-35, affiliated to the Tamilnadu Dr. M.G.R medical university, Chennai-32, under my guidance and direct supervision.

Prof. M. SHANKAR. M.P.T (NEURO), MIAP

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ABSTRACT

Subject objective : It is an experimental study design to determine the effectiveness of Sensory Integration and Conventional Physiotherapy on ADHD (Attention Deficit Hyperactivity Disorder).

DESIGN: The study was pre-test and post-test experimental group design.

Participants: A sample of 30 ADHD affected children were divided into 2 groups as follows:

Group A : Control group :Treated with Conventional Physiotherapy

Group B : Experimental group : Treated with Sensory Integration and Conventional Physiotherapy

Outcome measures : Conner's teacher rating scale used to measure the ADHD symptoms before and after the treatment.

Results : There was a significant improvement in the symptoms of ADHD in the subjects of both groups A and B, but more significant improvements were noted in the subjects of group B.

Conclusion : The study concludes that Sensory Integration is as effective as Conventional Physiotherapy in reducing the symptoms of ADHD. However the combination of both the therapies shows better improvements than the individual therapies.

CHAPTER I

1.1 INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD or AD/HD) is a neurobehavioral developmental disorder. ADHD is primarily characterized by the co-existence of attention problems and hyperactivity, with each behavior occurring infrequently alone. ADHD is the most commonly studied and diagnosed as psychiatric disorder in children affecting about 3 to 5% of children globally with symptoms starting before seven years of age. Srivastava et. al. marked 1% of ADHD prevalence in the total general population in India, whereas 3-3.5% of children may be diagnosed to suffer from ADHD. Though previously regarded as a childhood diagnosis, ADHD can continue throughout adulthood. 4.7 percent of American adults are estimated to live with ADHD. ADHD is diagnosed two to four times as frequently in boys as in girls though studies suggest this discrepancy may be due to subjective bias of referring teachers.

ADHD is unclear and there are a number of competing theories. Research on children with ADHD has shown a general reduction of brain volume, but with a proportionally greater reduction in the volume of the left-sided prefrontal cortex. In one study a delay in development of certain brain structures by an average of three years. The delay was most prominent in the frontal cortex and temporal lobe, which are believed to be responsible for the ability to control and focus thinking. In contrast, the motor cortex in the ADHD patients was seen to mature faster than normal, suggesting that both slower development of behavioral control and advanced motor development might be required for the fidgetiness that characterizes ADHD.

The neurotransmitters dopamine (DA) and norepinephrine (NE) are implicated in the pathophysiology of ADHD. Dopamine is a neurotransmitter involved in reward, risk taking, impulsivity, and mood. Norepinephrine modulates attention, arousal and mood. Brain studies on individuals with ADHD suggest a defect in the dopamine D4 (DRD4) receptor gene and overexpression of dopamine transporter-1 (DAT1). The DRD4 receptor uses DA and NE to modulate attention to and responses to one's environment. The DAT1 or dopamine transporter

protein takes DA/NE into the presynaptic nerve terminal so it may not have sufficient interaction with the postsynaptic receptor. Some study also found involvement of the "7-repeat" variant of the dopamine D4 receptor gene, which accounts for about 30 percent of the genetic risk for ADHD, in unusual thinness of the cortex of the right side of the brain; however, in contrast to other variants of the gene found in ADHD patients, the region normalized in thickness during the teen years in these children, coinciding with clinical improvement.

SPECT scans found people with ADHD to have reduced blood circulation (indicating low neural activity), and a significantly higher concentration of dopamine transporters in the striatum which is in charge of planning ahead. In 1990, Zametkin and colleagues compared positron emission topography (PET) scans of adults with and without ADHD. Global and regional glucose metabolism was reduced in adults who had been hyperactive since childhood. The largest reductions were in the premotor cortex and the superior prefrontal cortex. This was the first functional neuroimaging study to indicate brain differences in individuals with ADHD.

ADHD management usually involves some combination of medications, behavioral modifications, life-style changes and counseling. Each symptom can be difficult to differentiate from other psychiatric or other disorders, increasing the likely-hood that the diagnosis of ADHD is missed.

Methods of treatment often involves come combination of behavioral modifications, life-style changes, counseling and medication. A 2005 study found that medical management and behavioral treatment is the most effective ADHD management strategy, followed by medication alone, and then behavioral treatment.

Psychological therapy used to treat ADHD includes psycho-educational input, behavioral therapy, sensory integration, conventional physiotherapy, interpersonal psychotherapy, family therapy, school-based interventions, social-skills training and parent-management training. A 2009

review concluded that the evidence is strong for the effectiveness of behavioral treatments in ADHD.

Management with medication has been shown to be the most cost-effective, followed by behavioral treatment and combined treatment in a 14 month follow-up study. However, a longer follow-up study of 3 years found that stimulant medication offered no benefit over behavioral therapy. Stimulants are the most commonly prescribed medications for ADHD. The most common stimulant medications are the chain substituted amphetamine methylphenidate, dextromphetamine, mixed amphetamine salts and listex amphetamine. Atomoxetine is currently the only non-stimulant drug approved for the treatment of ADHD.

Sensory integration trained therapists use a neurophysiological approach to behavior that applies to and can improve hyperactivity and attention problems. They see hyperactive behavior as an information processing problem in the child nervous system. They apply the neurophysiological explanatory model to treatment provided by occupational, physical and speech therapists.

1.2 NEED FOR THE STUDY

ADHD is a common chronic disorder in children with 30 to 50% of those individuals diagnosed in childhood continuing to have symptoms into adulthood. If it left untreated, the persistent and pervasive effects of ADHD symptoms can insidiously and severely interfere with their ability to get the most out of education, fulfill potential in the workplace, establish and maintain interpersonal relationships, and maintain a generally positive sense of self.

Those with ADHD as children are at increased risk of a number of adverse life outcomes once they become teenagers. These include a greater risk of auto crashes, injury and higher medical expenses, earlier sexual activity and teen pregnancy.

Methods of treatment for ADHD often involve some combination of behavior modification, life-style changes and counseling. Physiotherapies used to treat ADHD include psycho educational input, sensory integration, conventional physiotherapy, cognitive behavioral therapy, interpersonal psychotherapy, family therapy, school-based interventions, social skills training and parent management training. Physiotherapy related to ADHD is found to be very rare and less reviews are consigned to ADHD. The main treatment was focused to occupational therapists and psychologists in the past, But it is in need for physiotherapists to treat those cases.

The importance and effects of multimodal therapy especially sensory integration and conventional physiotherapy are still not comprehensible and need to be studied.

Hence, the purpose of this study is to determine the effect ofsensory integration and conventional physiotherapy in children with ADHD.

1.3AIM OF THE STUDY

The aim of the study is tofind out the effectiveness of the application of the following therapies on ADHD:

1. Conventional Physiotherapy alone
2. Conventional Physiotherapy combined with Sensory Integration

1.4OBJECTIVES OF THE STUDY

1. To determine the effectiveness of Conventional Physiotherapy in ADHD.
2. To determine the effectiveness of Conventional Physiotherapy and Sensory Integration in ADHD.

1.5 HYPOTHESIS

Alternate hypothesis :

H01: There is statistically significant difference in the effects of the conventional physiotherapy on ADHD.

H02: There is statistically significant difference in the effects of combined conventional physiotherapy and sensory integrationon ADHD.

H03: There is statistically significant difference in the effects of conventional physiotherapy versus conventional physiotherapy combined with sensory integration on ADHD.

Null hypothesis :

H01: There is no statistically significant difference in the effects of the conventional physiotherapy on ADHD.

H02: There is no statistically significant difference in the effects of combined conventional physiotherapy and sensory integration on ADHD.

H03: There is no statistically significant difference in the effects of conventional physiotherapy versus conventional physiotherapy combined withsensory integration on ADHD.

1.6 OPERATIONAL DEFINITIONS

ADHD – Attention Deficit Hyperactivity Disorder

Attention deficit hyperactivity disorder (ADHD or AD/HD or ADD) is a developmental disorder. It is characterized primarily by "the co-existence of attentional problems and hyperactivity, with each behavior occurring infrequently alone" and symptoms starting before seven years of age.

ADHD is the most commonly studied and diagnosed psychiatric disorder in children, affecting about 3 to 5 percent of children globally and diagnosed in about 2 to 16 percent of school aged children. It is a chronic disorder with 30 to 50 percent of those individuals diagnosed in childhood continuing to have symptoms into adulthood. Adolescents and adults with ADHD tend to develop coping mechanisms to compensate for some or all of their impairments. It is estimated that 4.7 percent of American adults live with ADHD. Standardized rating scales such as the World Health Organization's Adult ADHD Self-Report Scale can be used for ADHD screening and assessment of the disorder's symptoms' severity.

From Wikipedia

Attention-deficit/hyperactivity disorder (ADHD) is a chronic condition that affects millions of children and often persists into adulthood. ADHD includes some combination of problems, such as difficulty sustaining attention, hyperactivity and impulsive behavior. Children with ADHD also may struggle with low self-esteem, troubled relationships and poor performance in school.

By Mayo Clinic

Attention deficit hyperactivity disorder (ADHD), a childhood mental disorder with onset before 7 years of age and involving impaired or diminished attention, impulsivity, and hyperactivity. Also called hyperactive child syndrome in the twentieth century.

By Mosby's Medical Dictionary, 8th edition. © 2009, Elsevier.

Sensory Integration

Sensory Integration: A form of occupational therapy in which special exercises are used to strengthen the patient's sense of touch (tactile), sense of balance (vestibular), and sense of where the body and its parts are in space (proprioceptive). It appears to be effective for helping patients with movement disorders or severe under- or over-sensitivity to sensory input.

By MedicineNet.com

Sensory Integration – Treatment focused on improving the way the brain processes and organizes the senses. Therapy is implemented by an occupational therapist and involves full-body movements that provide vestibular, proprioceptive and tactile stimulation.

Autism community

Sensory integration therapy or sensory integrative therapy attempts to treat Sensory Integration Dysfunction. Some of these treatments (for example, sensorimotor handling) have a questionable rationale and no empirical evidence. Other treatments have been studied, with small positive outcomes, but few conclusions can be drawn due to methodological problems with the studies. These treatments include prism lenses, physical exercise, auditory integration training, and sensory stimulation or inhibition techniques such as "deep pressure"—firm touch pressure applied either manually or via an apparatus such as a hug machine or a pressure garment. Although replicable

treatments have been described and valid outcome measures are known, gaps exist in knowledge related to sensory integration dysfunction and therapy. Because empirical support is limited, systematic evaluation is needed if these interventions are used.

From Wikipedia

CHAPTER II

REVIEW OF LITERATURE

1. **Ultimate Autism Guide(2011)**

Data suggests that the majority of children with autism also have sensory processing disorder (SPD). Both sensory integration therapy and fine motor therapy have been utilized by occupational therapists to treat sensory processing disorder. Previous studies focusing on sensory integration therapy have been lacking in quality. This study attempts to improve the controls utilized in clinical studies involving sensory integration while comparing the effectiveness of sensory integration therapy to fine motor therapy.

2. **May-Benson and colleagues (2010)**

evaluated the literature on the effectiveness of SIT on the ability of children with difficulty processing and integrating sensory information to engage in desired occupations and applied these findings to occupational therapy practice. Results suggested the SIT may result in positive outcomes in sensori-motor skills and motor planning; socialization, attention, and behavioral regulation; reading-related skills; participation in active play; and achievement of individualized goals. Gross motor skills, self-esteem, and reading gains may be sustained from 3 months to 2 years. Findings may be limited by type II error because of small sample sizes, variable intervention dosage, lack of fidelity to intervention, and selection of outcomes that may not be meaningful to clients and families or may not change with amount of treatment provided. The authors stated that replication of findings with methodologically and theoretically sound studies is needed to support current findings.

3. **Randye J. Dempl et al. (2009)**

studied on a randomized trial of mindfulnessbased cognitive therapy (MBCT-C) for children: promoting mindful attention to enhance social-emotional resiliency in children. They have taken 25 children including attention problem, behavioral problem and anxiety symptoms. They

demonstrated after 3 months of follow up that there was reductions in attention problems accounted for 46% of the variance of changes in behavior problems, although attention changes proved to be a non-significant mediator of behavior problems. Significant reductions in anxiety symptoms and behavior problems were found for those children who reported clinically elevated levels of anxiety. Their results showed that MBCT-C is a promising intervention for attention and behavior problems, and may reduce childhood anxiety symptoms.

4. **Nitkowski D et al. (2009)**

studied on behavior therapy and child welfare- results of an approach to improve mental health care of aggressive children. 25 children with conduct problems aged 7.6 to 13 years participated in study. They concluded that in comparison to the training, the combination of child welfare and training seemed to reduce a wider range of behavioral problems more effectively.
This indicates that combined intervention programs can optimize mental health care of aggressive children.

5.**Lucy Jane Liller et al.(2009)**

conducted a randomized controlled trial(RCT) pilot study of the effectiveness of occupational therapy using a sensoryintegration approach (SI) with children who had sensory modulation disorders(SMDs). 24 children (mean age 6.02) with SMD; in that 5 with ADHD, 3 withlearning disability and 1 with anxiety symptoms and other 15 children had noprevious diagnosis were randomly assigned to one of three treatment conditions; SI, Activity Protocol, and No Treatment. The SI group, compared to the other two groups, made significant gains on goal attainment scaling and on the Attention subtest and the Cognitive/Social composite of the Leiter International Performance Scale– Revised. Findings suggested that SI is effective in ameliorating difficulties of children with SMD.

6. **Scott H. Kollins, (2008)**

has done study using Medline review of literature on ADHD, substance use disorders and Psyschostimulant treatment. He concluded that in treating patients with ADHD and comorbid

substance use, populations must be a useful pharmacologic alternative. However, the risks of such treatment with high-risk populations must be considered alongside potential benefits.

7. **Fabiano et al. (2007)**

conducted a cross-over study on 48 children aged 5 to 12 years meeting DSM-IV criteria for ADHD for 9 weeks. They reported onclassroom behavior in a comparison between multi intensity behavioral modification and methylphenidate. They have shown behavioral modification was equivalent or better than all methylphenidate doses on measures of classroom rule violations and seatwork completion.

8. **Nathan Watemberg et al. (2007)**

conducted study on developmentalcoordination disorder (DCD) in children with ADHD and physical therapy (PT)intervention. DCD was detected in 55.2% of 96 consecutive children with ADHD (81 males, 15 females), mostly among patients with the inattentive type (64.3% compared with 11% of those with the hyperactive/impulsive type, $p<0.05$). Mean age was 8 years 4 months. Twenty-eight patients with ADHD and DCD randomly received either intensive group PT or no intervention. Physical therapy using perceptual motortraining, sensory integration therapy, kinaesthetic training and neuro developmental treatment.PT significantly improved motor performance (assessed by the Movement Assessment Battery for Children; $p=0.001$). In conclusion, DCD is common in children with ADHD, particularly of the inattentive type. Patients with both ADHD and DCD are more likely to exhibit specific learning disabilities and phonological (pronunciation) deficits. Intensive PT intervention has a marked impact on the motor performance of this children.

9. **Wigal et al. (2006)**

conducted comparative study of safety and tolerability of methylphenidate in preschool children with ADHD on 183 subjects meeting DSM-IV criteria, group 1 (n=53) given placebo and group 2 (n=61) given methylphenidate of 3 to 5.5 years of age for 70 weeks. They concluded that side effects significantly increased in methylphenidate group include decreased appetite ($p<0.03$),

trouble sleeping ($p<0.03$), weight loss ($p<0.05$), emotional out bursts ($p<0.03$) and social withdrawal ($p<0.03$). Around 11% of subjects withdrew from group 2 due to adverse events.

10. **Hample P et al. (2006)**

did a pilot study of multimodal therapy of childrenwith attention deficit/ hyperactive disorder and their parents in in-patientrehabilitation. In total 28 boys with ADHD 7 to 12 years old were included into quasiexperimental pre-post design and completed self-report questionnaires on psychological problems, coping and quality of life. In addition, 26 mothers evaluated the behavior problems, psychological problems and quality of life of their sons at the beginning and the end of inpatient rehabilitation. During 4-week in-patient rehabilitation all children and their mothers took part in a multimodal training containing components of behavior therapy and cognitive-behavioral therapy (selfinstruction, self-management, and stress management), applied in child-, parent-childand parent-centered interventions. They concluded that this multimodal therapy concept is an effective tool for the treatment of ADHD patients.

11. **RyoichiroIwanaga et al. (2006)**

conducted study on characteristics of thesensory-motor, verbal and cognitive abilities of preschool boys with attentiondeficit/hyperactivity disorder combined type in order to provide information for their treatment and education at preschool age by teachers and professionals. In total 46 boys with ADHD-combined type (ADHD-C) whose ages ranged from 45 to 72 months were examined using the Japanese version of the Miller Assessment for Preschoolers (JMAP), and were compared with 46 boys matched for age and gender in the normative samples. The results showed that the ADHD-C group was significantly lower than the normative sample group both on the Total score and on each Index score ($P < 0.01$) with the exception of the Non-verbal Index. The ADHDC group had significantly lower scores than the normative sample group in equilibrium, postural control, fine motor of hand and tongue, motor praxis, articulation, memory related to the comprehension of long sentences, and visual construction. Because fundamental sensory-motor abilities were notably lower in the ADHD-C group than in the normative sample group, it is

suggested that preschool boys with ADHD-C should be examined and treated for sensory-motor disabilities.

12. **Ercan ES et al. (2005)**

studied on effects of combined treatment on children diagnosed with attention-deficit/hyperactivity disorder. They included 47 ADHD with oppositional defiant disorder (ODD) and 36 children with ADHD & conduct disorder (CD) in study. Treatment consisted of ongoing medication (methylphenidate) management and a parent-training program that continued for 5 months. They gaveresult of the multimodal treatment study of children with ADHD, is stimulant medication was responsible for the improvement both in symptoms and in the motherchild relationship.

13. **Benjamin B. Lahey et al. (2004)**

published three year predictive validity of DSM-IV attention deficit hyperactivity disorder in children diagnosed at 4 to 6 years of age in American Journal of Psychiatry. The authors conducted four annual assessments of ADHD and functional impairment using multiple informants in 255 probands and matched comparison children who were 4–6 years old in wave 1 which includes greater social and academic impairments. Nearly all children who met full criteria for ADHD in wave 1 met full criteria for ADHD over the next 3 years and continued to display marked functional impairment relative to comparison children, even when intelligence, co-occurring psychopathology, and demographic characteristics were controlled. These findings support the validity of the DSM-IV diagnosis of ADHD in younger children by demonstrating that the symptoms and associated impairment are likely to persist well into elementary school.

14. **Paul S. et al. (2003)**

studied the effects of sensory motor activities protocol, based on sensory integration on children diagnosed with pre primary impairments. Control group (n=16), 6 boys and 10 girls, mean age 51.62 months received normal classroom activities. Experimental group (n=15), 7 boys and 8 girls, mean age 50.87 months received sensory integration therapy for 1 hour per day, 5 days per

week for 12 weeks. The treatments included were vestibular, proprioceptive, tactile, posture control activities, fine motor and speech training activities. The outcome measured used two assessments: De- GangiBerk Test of Sensory Integration (TSI) and the Miller Assessment for Preschoolers (MAP), which measured sensory, motor andcognitive skills. The authors concluded that implementing SIT protocol helped the children in the experimental group, improved their scores, while the scores for the controlled group were not so affected.

15. **Wang J et al. (2003)**

conducted a case-control study on balance function ofADHD children. They have taken 80 ADHD children and 80 non-ADHD childrenclassified according to the diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorder (DSM-IV). They concluded that ADHD children have poor stability, abnormal sensory integration and visual, somatosensory, vestibular function deficits. There is correlation between balance dysfunction and the clinical symptoms and the deficits in behavior and cognition.

16. **Rebecca R. Gerhardstein et al. (2003)**

studied on factor structure of theConner's Teacher Rating Scale in low income preschool sample. This study examined the structural characteristics of the CTRS in a sample of 235 low-income, primarily African American, preschool children. Children were rated on the CTRS by an assessment research assistant, an intervention research assistant, and a classroom teacher. Multiple exploratory factor analyses converged on the same basic three-factor solution. The three factors could be labeled Hyperactivity/Impulsivity, Inattention, and Oppositional Behavior. This three-factor solution did not correspond to the published factor structure of the CTRS. Instead, it more closely paralleled consensus ratings of experts in the field of child psychology and the criteria for behavior disorders according to the DSM-IV.

17. **Ana Miranda et al., (2002)**

studied to evaluate the efficacy of amulticomponent program for treating attention-deficit/hyperactivity disorder(ADHD). Dependent measures included neuropsychological tasks,

behavioral ratingscales for parents and teachers, direct observation of behavior in the classroom, and academic records of children with ADHD. 50 children with ADHD participated in the study, and applied behavior modification techniques, cognitive behavior strategies, and instructional management strategies. The other 21 students formed the control group. Parents' and teachers' ratings detected improvements in primary symptoms (inattention—disorganization, hyperactivity—impulsivity) and in behavioral difficulties usually associated with ADHD. The results showed increased academic scores, enhanced classroom behavioral observations, and improved teachers' knowledge about the strategies directed toward responding to the children's educational needs.

18. **Du Paul et al., (2001)**

studied to examine differences in home, school andmedical functioning between preschool age children with ADHD and normal control children. Total 94 children between 3 and 5 years of age included based on parent and teacher ratings of problem behavior and social skills, parent rating of stress and family functioning, medical functioning data, observations of parent-child interactions and classroom behavior and a test of pre academic skills. Results indicated that preschoolage children with ADHD are at significant risk of behavioral social, familial and academic difficulties relative to their normal control parts. No significant differences in injuries or utilization of medical services were found.

19. **ShanleyDonelanMangeot et al., (2001)**

conducted the study to investigate the presence of sensory modulation dysfunction among children with ADHD. Twenty-six children with ADHD (mean age 8.3 years, 18 males, 8 females), and 30 typically developing children (mean age 8.2 years, 21 males, 9 females) were tested using a laboratory procedure that gauges responses to repeated sensory stimulation bymeasuring electro dermal reactivity (EDR). Parental report measures of limitations in sensory, emotional, and attentional dimensions were administered using the Short Sensory Profile, the Leiter International Performance Scale–Revised, Parent Rating subscales, and the Child Behavior Checklist (CBCL). Compared to the typical sample, the children with ADHD displayed greater abnormalities in sensory modulation on both physiological and parent-report measures.

20. **C. Keith Conners, (1998)**

updated the original Conner's Rating Scale. Thenormative sample consisted of over 8000 cases. The coefficient alphas for internal reliability were highly satisfactory for the normative groups. For the long form there was a range from .728 to .942 and .857 to .938 for the short form of the CRS-R, indicating that the CRS-R subscales are accurate in measuring the constructs they were intended to measure. CRS-R correlations were also done between the teacher, patent and adolescent ratings. The results indicate that the CRS-R does in fact identify childhood and adolescent ADHD behavioral problems and psychopatholoty.

21. **Barkley, (1998)**

studied that the DSM-IV52 is some of the most rigorous andempirically derived criteria ever created in the history of clinical diagnosis forADHD. This version of the DSM was based on items used in rating scales that have a high inter correlation to each other and are valid in distinguishing ADHD from other groups of children.

22. **Kaduson and Finnerty, (1995)**

conducted a study on self-control gameintervention for attention-deficit hyper activity disorder with sixty-three children between the ages of eight and twelve. The authors compared three groups of children diagnosed with ADHD using a game (Self-control Game) for one group, biofeedback for another and a control strategic game only in the final group. Results indicatedbiofeedback was the most effective in improving the child's self-perception of selfcontrol. All three groups indicated a significant improvement in sociability and attention.

CHAPTER III

MATERIALS AND METHODOLOGY

3.1 MATERIALS REQUIRED

1. Informed consent
2. Assessment form
3. Conner's teacher's rating scale
4. Instruments:
    a) physio ball of 75"
    b) medium size bolster
    c) scrubbers
    d) torch
    e) small bell
    f) some light instrumental music
    g) vibrator (240v, 50-60 Hz and 450w, head size 35mm)
    h) some games and puzzles

3.2 METHODOLOGY

3.2.1 STUDY DESIGN

The study was an experimental study design with pretest and post test evaluation both in experimental and control group.

3.2.2 SAMPLING DESIGN

The subjects are selected by non-probability purposive sampling technique.

3.2.3 POPULATION

The sample size consist of 30 subjects with ADHD were selected and divided into Group A - Control group and Group B - Experimental group.

Control group : Consists of 15 ADHD affected children treated with conventional physiotherapy.

Experimental group: Consists of 15 ADHD affected children treated with conventional physiotherapy and sensory integration.

.3.2.4 SAMPLE

30 Subjects were included in the study.

3.2.5 SELECTION CRITERIA

Inclusion Criteria

- Age – 4 to 6 years.
- Gender – Male and female.
- ADHD Diagnosed with DSM-IV criteria

Exclusion criteria

- Physical disability including hearing or vision.
- Hypothyroidism.
- Mental retardation.
- Associated psychological disorders like conduct disorder, mood disorder, bipolar and anxiety disorder.
- On medication for ADHD.
- Score > 100 in Conner's teacher rating scale

3.2.6 STUDY SETTING

Study was conducted in the department of physiotherapy, J.C.Paediatric Care, Madurai.

3.2.7 STUDY METHOD

Subjects were divided into control group and experimental group.

Control Group: 15 Subjects were treated with conventional physiotherapy

Experimental Group: 15 subjects were treated with conventional physiotherapy and sensory integration

3.2.8 STUDY DURATION

The study was carried out for a period of 6 months.

3.2.9 TREATMENT DURATION

The study was conducted for 6 months and individual subjects were treated 5 days a week with each session lasting for an hour.

3.2.10 PARAMETER

Conner's teacher rating scale**.**

3.2.11 STATISTICAL TOOLS

Unpaired ‘t’ test or Independent ‘t’ test

Independent ‘t’ test was used to compare pre-pre and post-post values of Experimental and Control groups,.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S}$$

$$S = \sqrt{\frac{n_1 n_2}{n_1 + n_2 - 2}}$$

n1 = total number of subjects in Group A

n2 = total number of subjects in Group B

X1 = difference between the pre-test and post-test values of Group A

$\bar{X}1$ = mean difference between pre-test and post-test values of Group A

X2 = difference between the pre-test and post-test values of Group B

$\bar{X}2$ = mean difference between pre-test and post-test values of Group B

Note : The pre-test and post-test values were measured using the Conner’s teacher rating scale.

Paired ‘t’ test or Dependent ‘t’ test

Dependent ‘t’ test was used to find out the statistical significance between pre-test and post-test values of the subject treated with conventional physiotherapy and sensory integration.

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

$$s = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$\underline{d}$ = difference between the pre-test and post-test values

$\bar{d}$ = mean difference

n= number of observations

S = standard deviation

Note : The pre-test and post-test values were measured using the Conner’s teacher rating scale.

3.2.12TREATMENT TECHNIQUES

Sensory Integration (Experimental Group)

Subjects were treated with

1. Tactile (brushing) – brushing stimulates nerve endings under the skin that send information to the brain. This includes information about light, touch, pressure, pain and temperature. Tactile information plays an important role in our perception of the environment.
2. Vestibular (swing, rolling, spinning) – The vestibular senses are very important to one's sense of balance and gravitational security.
3. Proprioception (bouncing on trampoline or large ball, pushing activities, playing with weights) – This system refers to information provided from the joint muscles and tendons to the brain that tells us where our body is in relation to other subjects. This gives us knowledge about our body position.
4. Auditory (sing-songs, loud and slow noise)
5. Visual (focusing, following and tracking)

Conventional Physiotherapy(Control Group and Experimental Group)

Subjects were treated with

1. Stretching –Passive stretching for affected muscles
2. Resistance Exercises–These exercises are considered an integral part of any rehabilitation program. Many physiotherapists will suggest to their clients who have had shoulder, knee, or ankle surgery, to do resistance band exercises as part of rehab, particularly as self exercises which they can just do at home, to regain strength in the muscles where the injury occurred.

3.2.13 PROCEDURE

1. The subjects were screened based on the inclusion and exclusion criteria and signified their voluntary decision to participate.
2. The purpose and procedure of the study was explained to the parents/ care takers and informed consent was obtained.
3. Information about the ADHD was also explained. 30 subjects of ADHD were included in study that fulfills the inclusion criteria after thorough physical objective evaluation, by using assessment form.
4. All subjects were randomly divided into Group A (Control group), Group B (Experimental group).
5. All selected subjects were assessed with Conner's teacher rating scale before intervention.
6. Sensory Integration included tactile (brushing), vestibular (swing, rolling, spinning), proprioception (bouncing on trampoline or large ball, pushing activities, playing with weights), auditory (sing-songs, loud and slow noise) and visual (focusing, following and tracking) input. The session was for one hour per day and it was for 5 days per week.
7. ConventionalPhysiotherapy included stretching and resistance exercises. The session was for one hour per day and it was for 5 days per week.
8. Total time duration for the therapy was 6 months after which all the subjects were reassessed by Conner's teacher rating scale to know the outcome.

CHAPTER IV

DATA PRESENTATION

Control Group Master Data

Sl. No.	Control Group (Group A)			
	Age in years	Sex	CTRS	
			Pre-Test	Post-Test
1	5.5	M	85	65
2	4.11	M	79	67
3	5.10	M	78	62
4	4.3	M	78	69
5	6	F	82	70
6	4.11	M	77	69
7	4.6	M	80	74
8	4.11	F	84	65
9	5.6	F	82	70
10	4	M	79	73
11	4.6	M	77	73
12	5.7	M	76	65
13	5.3	M	83	67
14	5.2	M	80	69
15	4.8	M	81	77
Mean			80	69

Table 1 : Control Group Master Data

Experimental Group Master Data

Sl. No.	Experimental Group (Group B)			
	Age in years	Sex	CTRS	
			Pre-Test	Post-Test
1	5.5	M	69	65
2	4.11	M	74	66
3	5.10	M	65	60
4	4.3	M	70	68
5	6	F	73	64
6	4.11	M	73	63
7	4.6	M	65	62
8	4.11	F	67	63
9	5.6	F	69	68
10	4	M	72	67
11	4.7	M	73	73
12	5.9	M	68	62
13	4.11	M	65	64
14	5	F	68	66
15	4.6	F	68	65
Mean			69	65

Table 2 : Experimental Group Master Data

CHAPTER V

DATA ANALYSIS AND INTERPRETATION

Unpaired ‘t’ test results for Group A Pre-Test and Group B Pre-Test values

Sl. No	Group	Mean	Mean Difference	Standard Deviation	‘t’ value
1	Control Group (Group A)	80	11	2.834	3.88
2	Experimental Group (Group B)	69			

Table 3 : Unpaired 't' test for Pre-Test values

The above table shows that the unpaired ‘t’ test for the pre-test values of both groups resulted in ‘t’ value = 3.88 with standard deviation = 2.834 and mean difference = 11.

Unpaired ‘t’ test results for Group A Post-Test and Group B Post-Test values

Sl. No	Group	Mean	Mean Difference	Standard Deviation	‘t’ value
1	Control Group (Group A)	69	4	2.834	1.41
2	Experimental Group (Group B)	65			

Table 4 : Unpaired 't' test for Post-Test values

The above table shows that the unpaired ‘t’ test for the post-test values of both groups resulted in ‘t’ value = 1.41 with standard deviation = 2.834 and mean difference = 4.

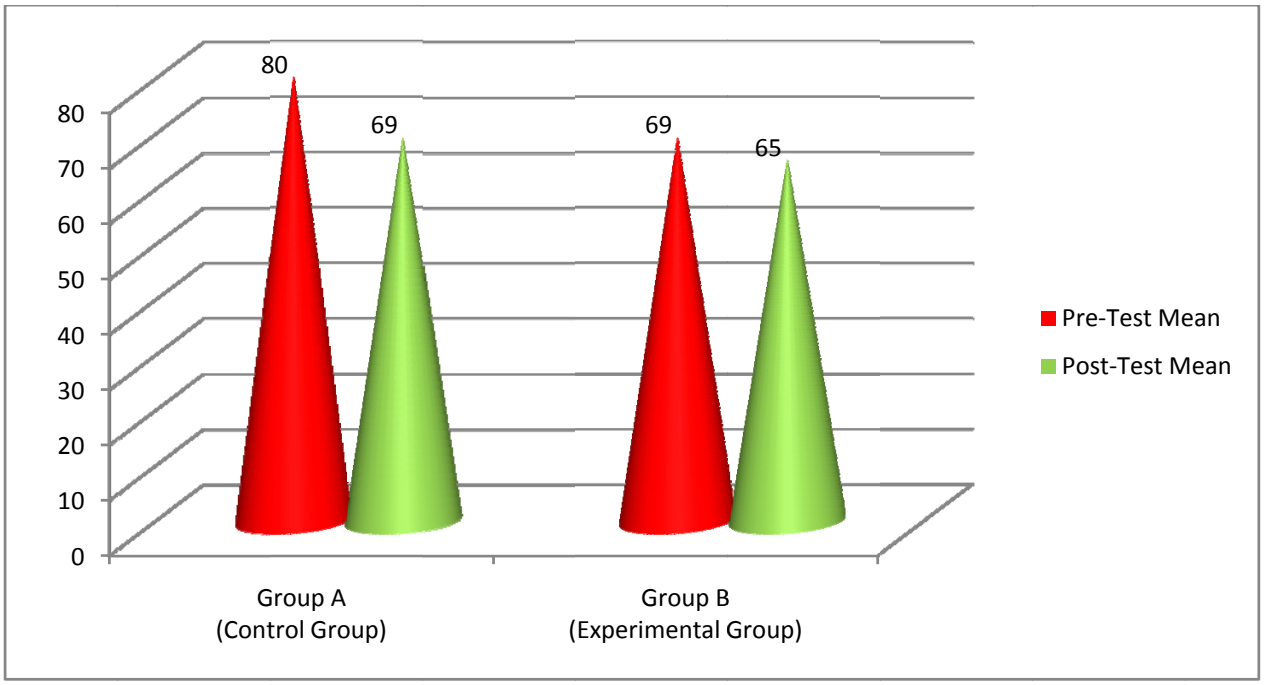

Figure 1 : Pre-Test and Post-Test Mean values

As shown above the mean post-test values of both groups are less than the mean pre-test values. This indicates that both groups had a significant improvement in the symptoms of ADHD after the treatment.

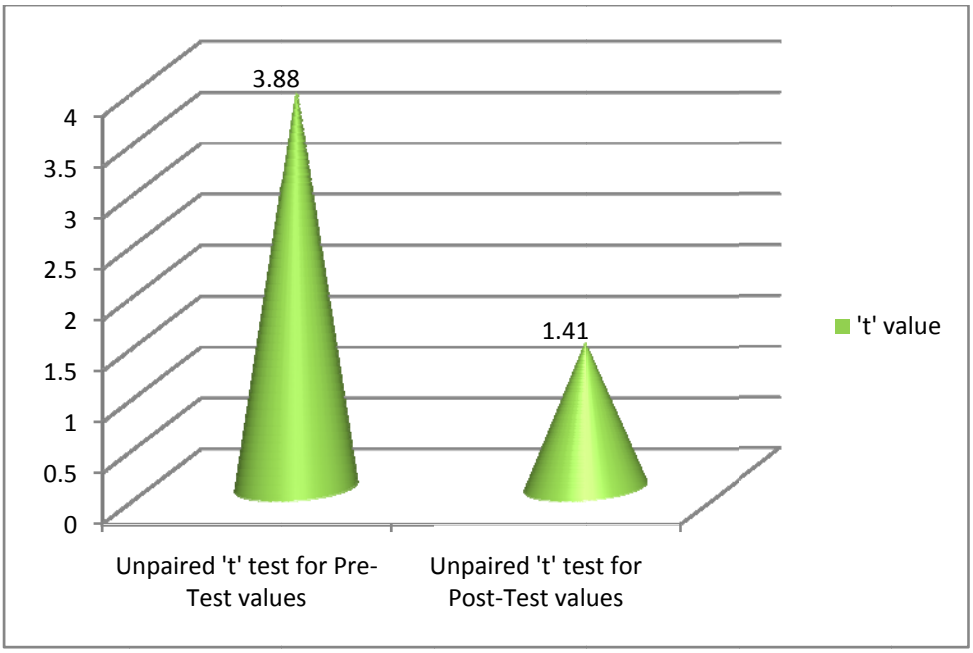

Figure 2 : Unpaired 't' test values

As shown above, the ‘t’ value for the post-test values of both groups is less than the ‘t’ value of the pre-test values of both groups. This indicates that both groups had significant improvement in the symptoms of ADHD after being treated with the conventional physiotherapy and sensory integration therapy.

Paired ‘t’ test results for Group A

Sl. No	Group A	Mean	Mean Difference	Standard Deviation	‘t’ value
1	Pre-Test	80	11	6.637	9.07
2	Post-Test	69			

Table 5 : Paired ‘t’ test results for Group A

The above table shows that the paired ‘t’ test for Group A resulted in ‘t’ value = 9.07 with standard deviation = 6.637 and mean difference = 11.

Paired ‘t’ test results for Group B

Sl. No	Group B	Mean	Mean Difference	Standard Deviation	‘t’ value
1	Pre-Test	69	4	2.986	7.34
2	Post-Test	65			

Table 6 : Paired ‘t’ test results for Group B

The above table shows that the paired ‘t’ test for Group B resulted in ‘t’ value = 7.34 with standard deviation = 2.986 and mean difference = 4.

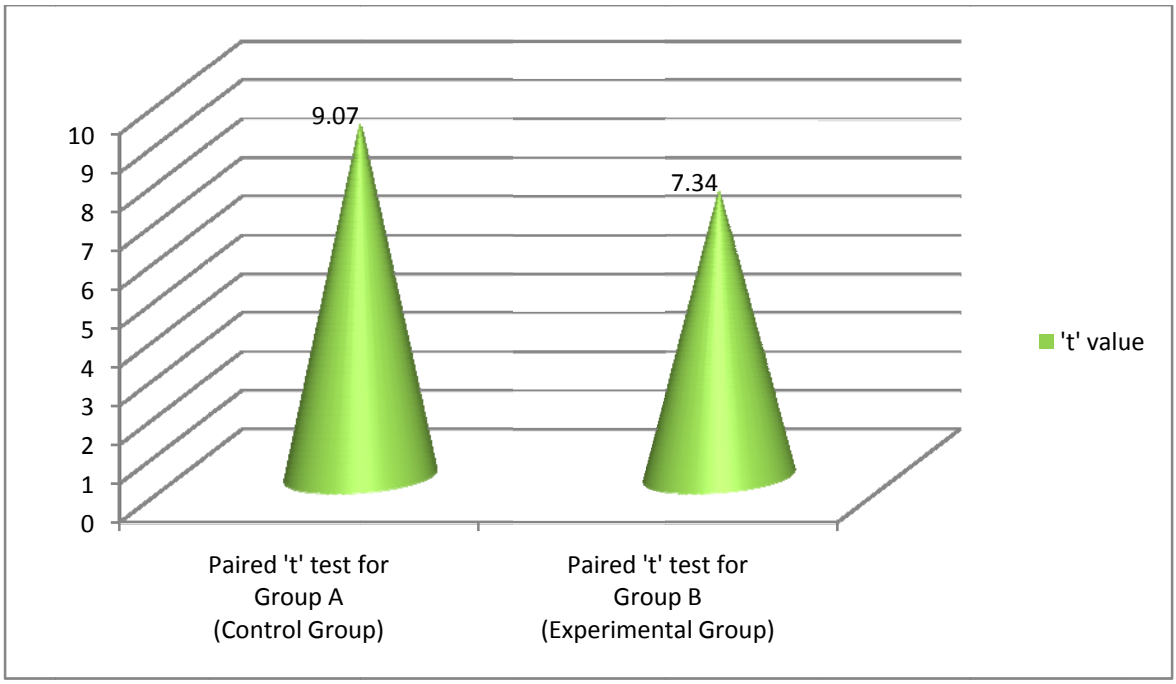

Figure 3 : Paired 't' test values

As shown above, the ‘t’ value for Group B is less than the ‘t’ value for Group A. This indicates that the Group B which was treated with the combination of the conventional physiotherapy and the sensory integration had more significant improvements in the symptoms of ADHD than Group A which was treated with the conventional physiotherapy alone.

CHAPTER VI

RESULTS

As seen with the unpaired ‘t’ tests, the ‘t’ value for the post-test values of both groups is less than the ‘t’ value for the pre-test values of both groups. This shows that the post-test values of both groups indicate a reduction in the symptoms of ADHD significantly.

As seen with the paired ‘t’tests, the ‘t’ value for Group B is less than the ‘t’ value for Group A. This shows that the treatment for Group B had more significant improvements than Group A in treating the symptoms of ADHD.

This indicates that the combined treatment of conventional physiotherapy and sensory integration is better than the treatment with only the conventional physiotherapy.

CHAPTER VII

DISCUSSION

Attention-deficit hyperactive disorder is the most frequently diagnosed behavioral disorder and the most abundantly researched in child psychiatry. This disorder consists of a combination of behavioral features, including developmentally inappropriate levels of inattentiveness to task, distractability, impulsiveness and motor over-activity. ADHD is strongly associated with pure accademic performance, a pattern of conflictual and often unsatisfactory relations with peers, family members and teachers, and low self-esteem. To answer the question of optimal types and frequency of therapy, head to head comparison in which participants are randomly assigned to receive different therapies are highly needed. There was numerous theories proposed for the effectiveness of various interventions in the treatment of ADHD.

Various evidences are supporting the conventional physiotherapy and sensory integration. In this study, the first group was treated with conventional physiotherapy(Group A), the second group was treated with the combination of conventional physiotherapy and sensory integration (Group B). A total of 6 months of treatment was given for both the groups. There was an improvement found in the reduction of the ADHD symptoms in both the groups after the intervention.

Analysis was done by comparing the ‘t’ values derived by using the unpaired ‘t’ tests for the pre-test values of both groups and the post-test values of both groups. The ‘t’ value for the post-test values of both groups was found to be less than the ‘t’ value for the pre-test values of both groups. This indicates that there was a significant improvement in the symptoms of the subjects in both groups after the treatment.

Also, an analysis was done by comparing the ‘t’ values derived by using the paired ‘t’test for Group A and Group B. The ‘t’ value for Group B was found to be less than the ‘t’ value for Group A. This indicates that the treatment with the combination of the conventional physiotherapy

and sensory integration had more significant results than the treatment with the conventional physiotherapy alone.

CHAPTER VIII

CONCLUSION

The study concludes that both treatments, that is the combined treatment of conventional physiotherapy and sensory integration (Experimental Group) and the treatment of conventional therapy alone (Control Group) yields significant results in reducing the symptoms of ADHD.

However, the study also shows that the combined treatment of conventional physiotherapy and sensory integration (Experimental Group) yields more significant results than the treatment of conventional therapy alone (Control Group).

CHAPTER IX

LIMITATIONS &SUGGESTIONS

Limitations

1. Thisstudywaslimitedintheagegroupfrom4to6years.
2. Thesamplesizeusedforthestudywassmall.
3. Longtermeffectsoftreatmentwerenotassessed.
4. Thisstudywaslimitedinchildrenwithoutmedication.
5. Co-operationofchildrenduringtreatmentsessionwasvarying.

Suggestions

1. Further studies can be conducted with different age groups and gender.
2. The sample of this study design was small and it can be done on larger sample.
3. The long term effects can be evaluated with these treatments in ADHD.
4. Further studies can be conducted with medication.
5. Further studies can be done on learning disabilities, Autistic spectrum disorders and other sensory modulation.
6. Further studies can be conducted with diet prescription, environmental modification, music therapy and family training.

CHAPTER X

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CHAPTER XI

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CHAPTER XII

APPENDIX -1

PATIENT CONSENT FORM

TITLE : **EFFECTIVENESS OF SENSORY INTEGRATION ON ATTENTION DEFICIT HYPERACTIVITY DISORDER**

Investigator : ----------

PURPOSE OF THE STUDY :

I ----------,have been informed that this study will work towards achieving an improvement in the symptoms of ADHD in me.

PROCEDURE :

Each term of the study protocol has been explained to me in detail.I understand that during the procedure ,I will be receiving the treatment for one time a day for 5 days in a week.I understand that I will have to take this treatment for 6 months.

I understand that this will done under investigator ,---------- supervision .I am aware also that I have to follow therapist's instructions as told to me.

CONFEDENTIALITY :

I understand that medical information provided by this study will be confidential. .If the data are used for publication in the medical literature or for teaching purposes,no names will be used and other literature such as audio or video tapes will be used only with permission.

RISK AND DISCOMFORT :

I understand that there areno potential risks associated with this procedure,and understand that investigator will accompany me during this procedure. There is no known hazards associated with this procedure.

REFUSAL OR WITHDRAWAL OF PARTICIPATION :

I understand that the decision my participation is wholly voluntary and I may refuse participate,may withdraw consent at any time during the study .

I also understand that the investigator may terminate my participation in the study at any time after researcher has explained me the reasons to do so.

I ----------have been explained the purpose of the research ,the procedures required and the possible risks and benefitsto the best of my ability,I have read and understood this consent to participate as a subject in this research project.

Signature of the witness : DATE :

Signature of the parent :

APPENDIX-2

PATIENT PROFILE

NAME :
AGE :
SEX :
OCCUPATION :
DATE OF ASSESSMENT :
CHIEF COMPLAINTS :

SUBJECTIVE
a)History
Present medical history
Past medical history
b)Surgical history
c)Drug history
d) Personel history
e)Family history
ON OBSERVATION
a)Built
b)Swelling
c)Soft tissue contours

VITAL SIGNS
a)Temperature
b)Blood pressure
c)Heart rate
d)Respiratory rate

EXAMINATION ;

1. Higher functions
2. Mental status
3. Speech
4. Hearing Sensory system
5. Vision
6. Cranial nerves
7. Sensory system

8. sensation
9. Motor system
10. Reflexes
11. Co-ordination
12. Involuntary movements
13. Balance
14. Gait analysis
15. hand function
16. Assistive devices

17.Functional assessment

PROBLEM LIST

MEANS

APPENDIX –3

Conner's Teacher Rating Scale

TEACHER'S RATING SCALE

Child's Name_____ Date of Rating:_____AM PM

Teacher's Name:_____

	Not a: all	Just a little	Pretty much	Very much
Classroom Behavior				
Constantly fidgeting	0	1	2	3
Hums and makes other odd noises	0	1	2	3
Demands must be met immediately - easily frustrated	0	1	2	3
Coordination poor	0	1	2	3
Restless or overactive	0	1	2	3
Excitable, impulsive	0	1	2	3
Inattentive, easily distracted	0	1	2	3
Fails to finish things - short attention span	0	1	2	3
Overly sensitive	0	1	2	3
Overly serious or sad	0	1	2	3
Daydreams	0	1	2	3
Sullen or sulky	0	1	2	3
Cries often and easily	0	1	2	3
Disturbs other children	0	1	2	3
Quarrelsome	0	1	2	3
Mood changes quickly and drastically	0	1	2	3
Acts "smart"	0	1	2	3
Destructive	0	1	2	3
Steals	0	1	2	3
Lies	0	1	2	3
Temper outbursts, explosive and unpredictable behavior	0	1	2	3
Group Participation				
Isolates self from other children	0	1	2	3

Appears to be unaccepted by group	0	1	2	3
Appears to be easily led	0	1	2	3
No sense of fair play	0	1	2	3
Appears to lack leadership	0	1	2	3
Does not get along well with opposite sex	0	1	2	3
Does not get along well with same sex	0	1	2	3
Teases other children or interferes with their activities	0	1	2	3
Attitude toward Authority				
Submissive	0	1	2	3
Defiant	0	1	2	3
Impudent	0	1	2	3
Shy	0	1	2	3
Fearful	0	1	2	3
Excessive demands for teacher's attention	0	1	2	3
Stubborn	0	1	2	3
Overly eager to please	0	1	2	3
Uncooperative	0	1	2	3
Absences from school	0	1	2	3
Overall, this child is a problem...				